technische universität dortmund

LAMARR INSTITUTE FOR MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

astroparticle physics

Reconstruction of Radio Interferometer Measurements of Protoplanetary Disks using `radionets`

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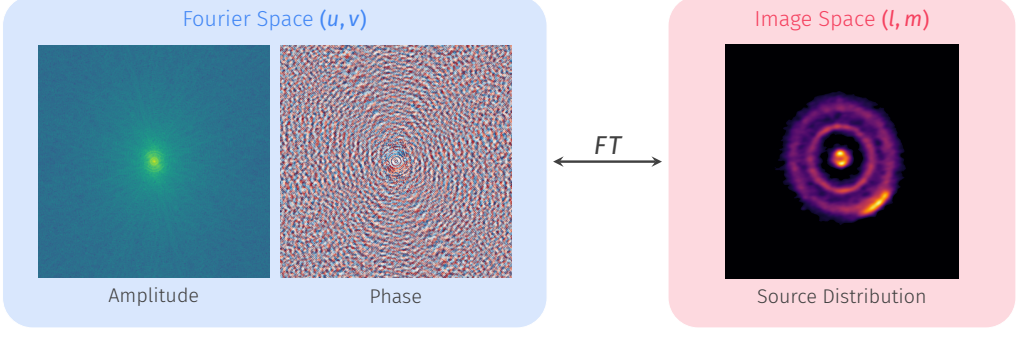
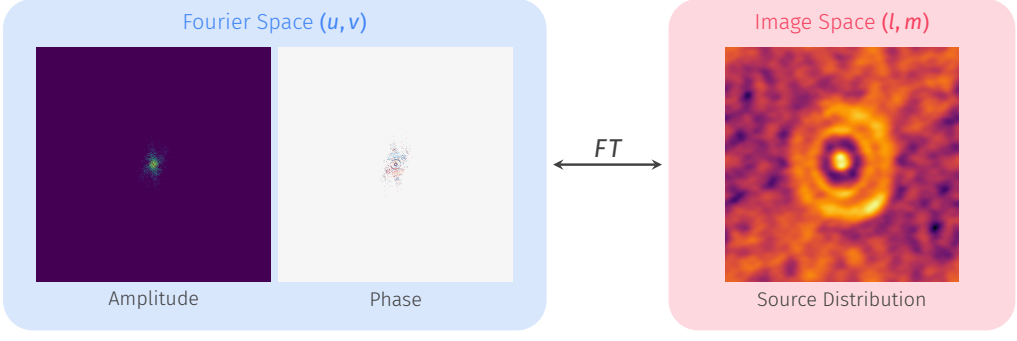
Lab Visits 2026.1

Measurement Problem in Radio Interferometry



Source distribution from **Sean M. Andrews et al.** DOI: `10.3847/2041-8213/aaf741`

Measurement Problem in Radio Interferometry



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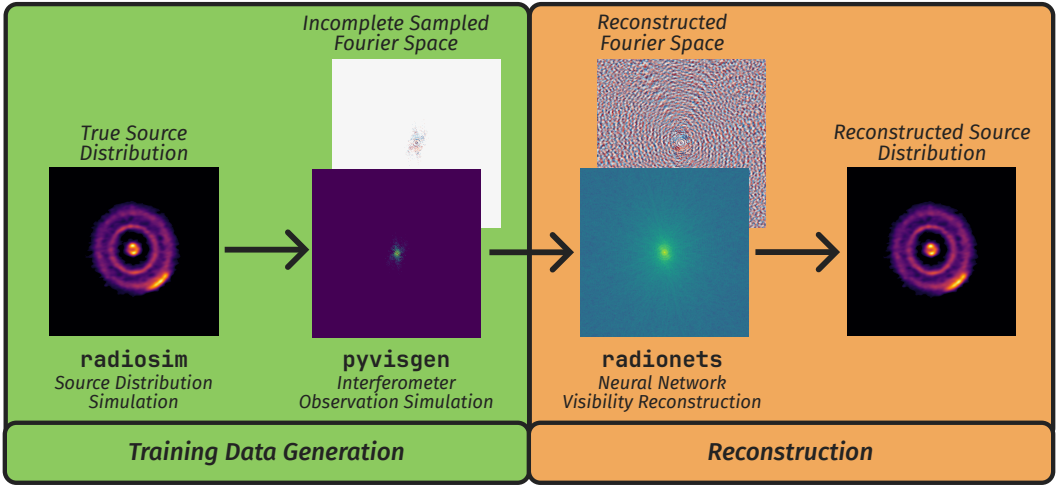
radionets-project



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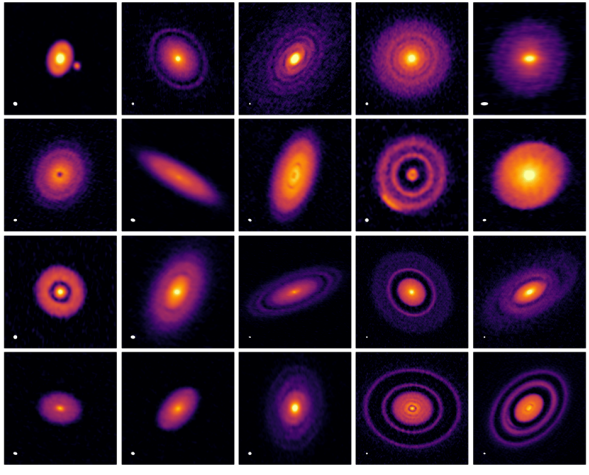
DSHARP Observations



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Simulating Protoplanetary Disks

Logos Sources: Python Software Foundation. *Python Logo*, Qq1040058283. *C Logo*, Fortran-lang community. *Fortran Logo*

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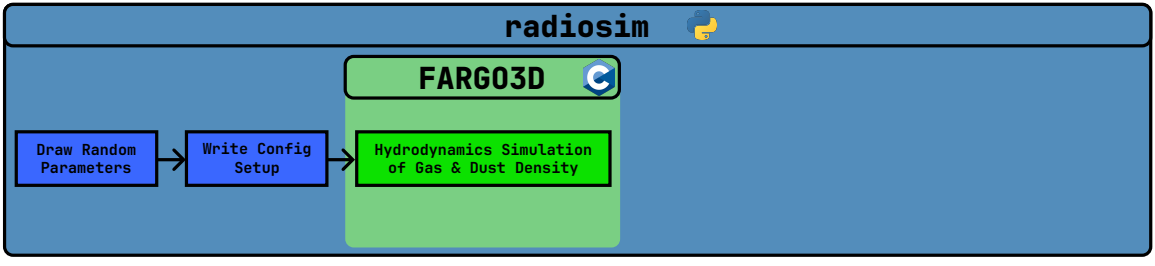

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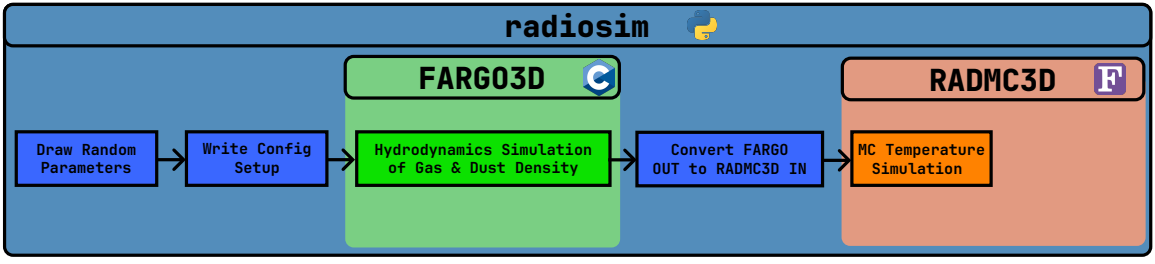

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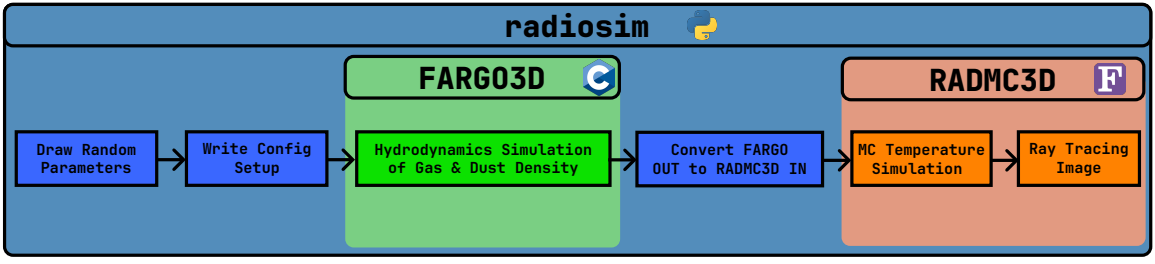

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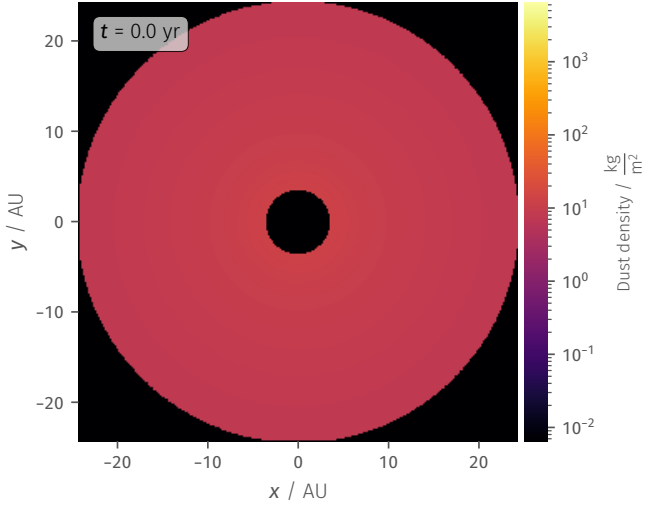
Dust Surface Density



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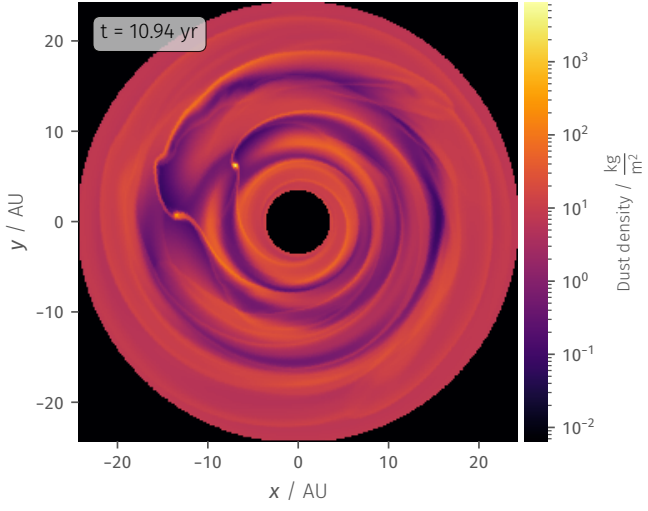

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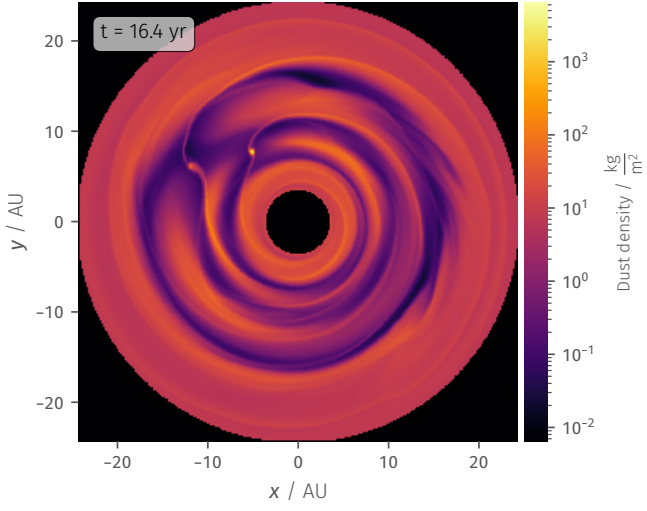

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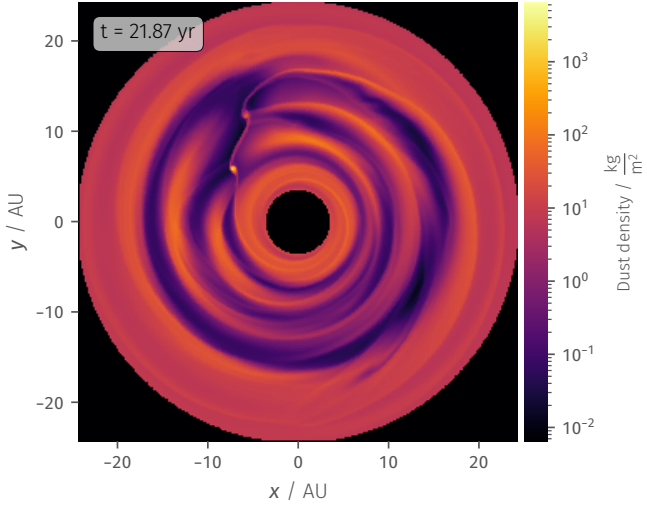

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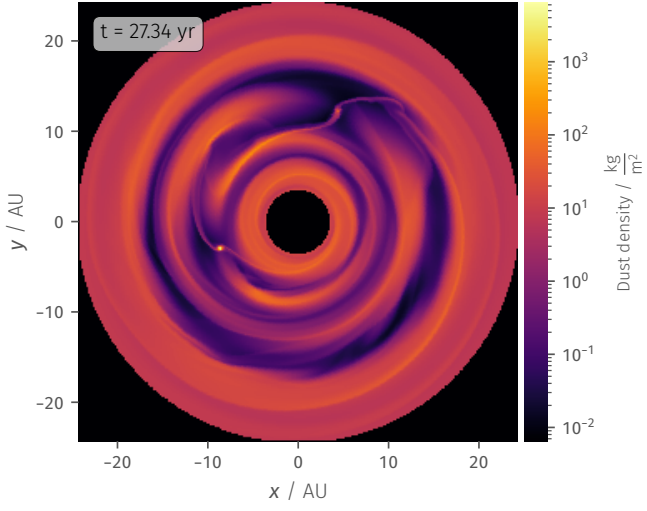

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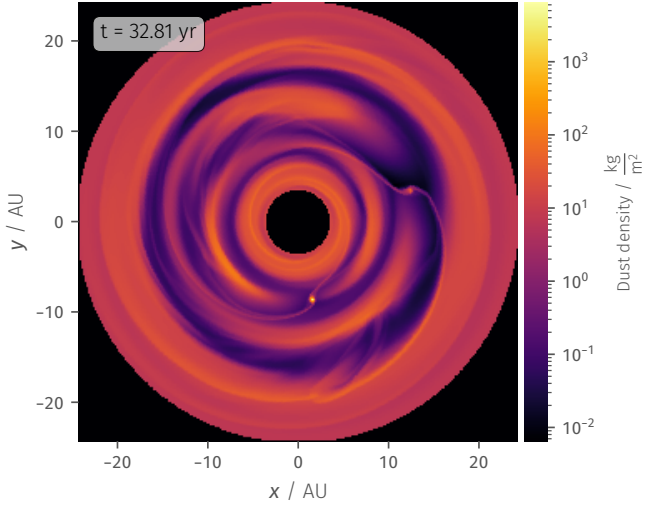

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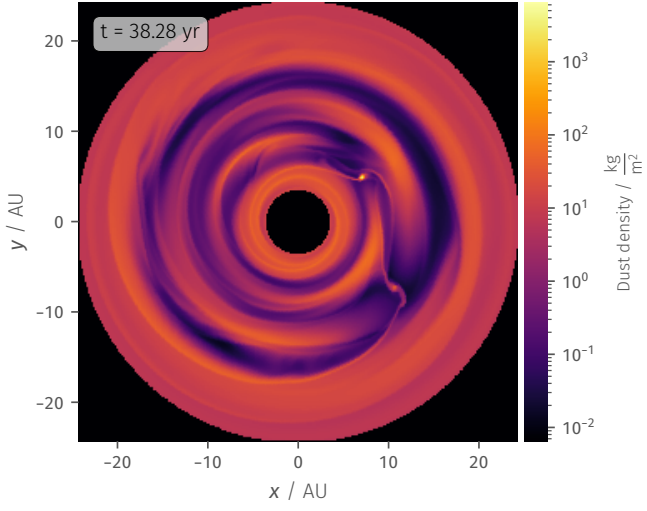

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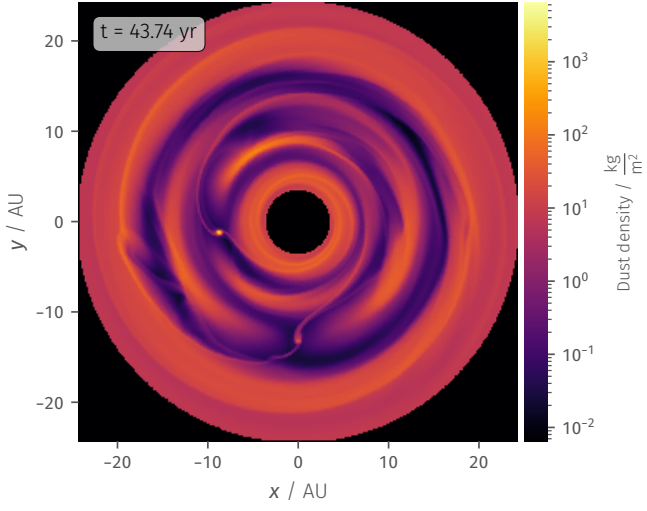

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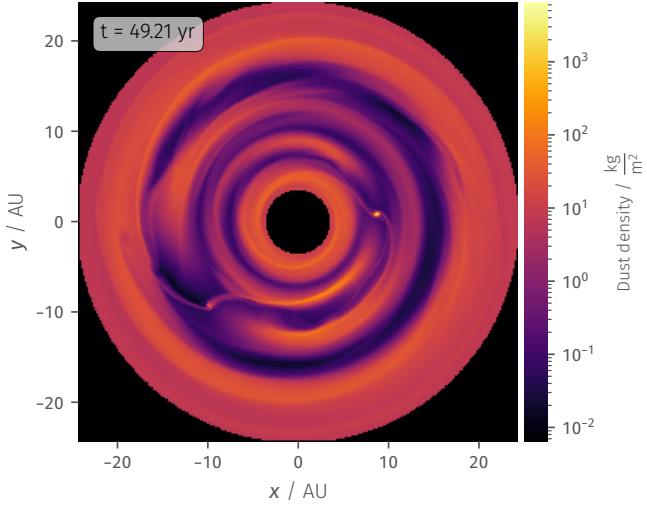

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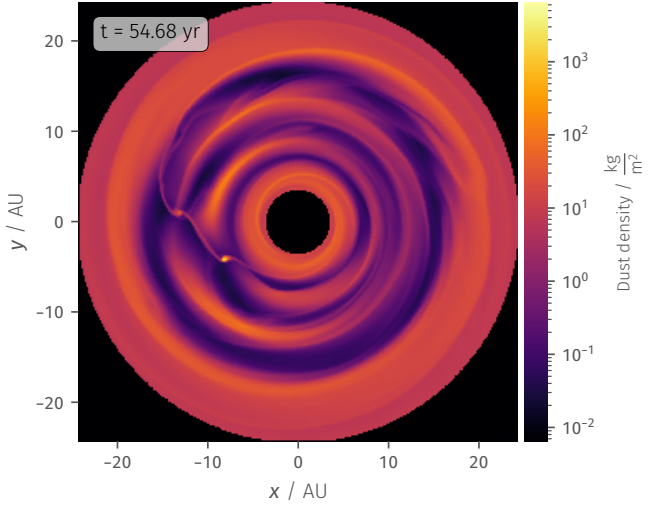

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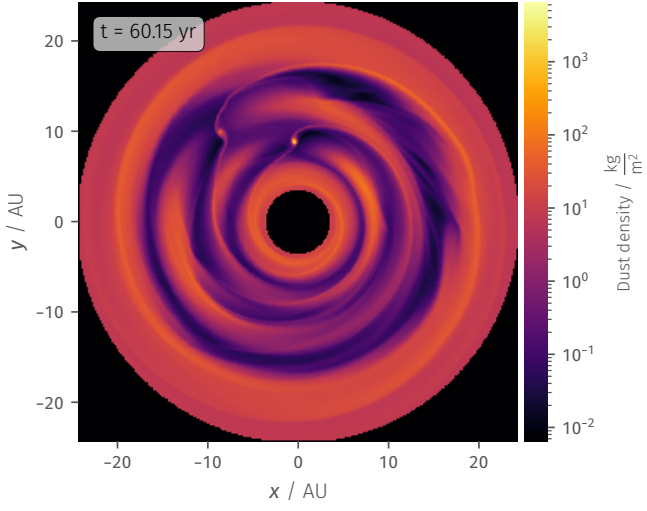

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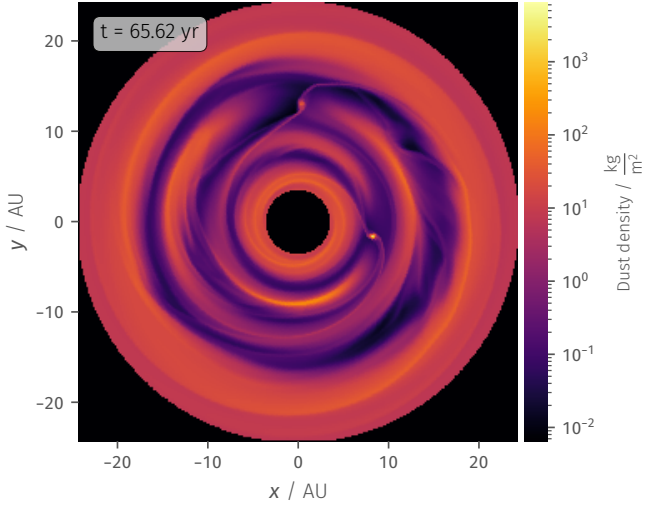

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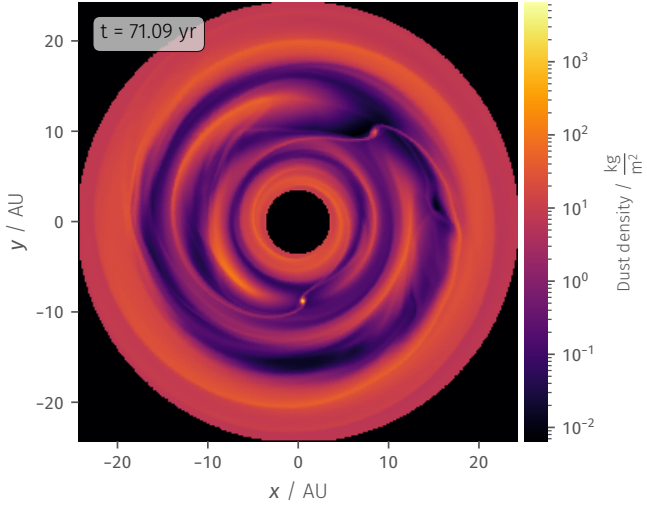

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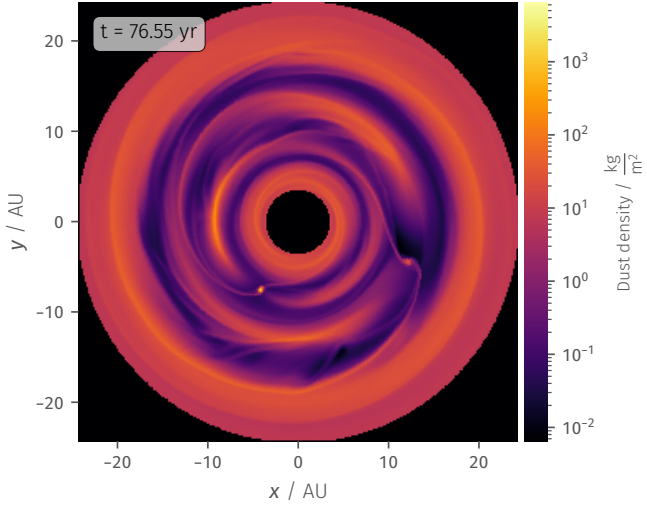
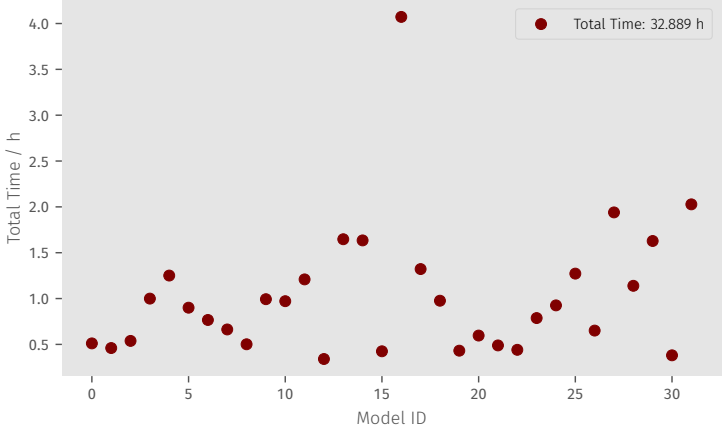


The Runtime Problem



→ **Problem:** 1 h · 10000 ≈ 1.1 yr

Accelerating Simulations

! **Most expensive:** Hydrodynamics Simulation →Run as few as possible

- Generate fewer densities and train a Generative Neural Network (e.g. Variational Autoencoder) to generate more samples
- Use same model multiple time
  - → at different time steps
  - → at different inclinations (e.g. *face-on*, *edge-on*)
  - → with different optical properties (in `RADMC-3D`)